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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PTO-PAT-Email@rfem.com

Office Action Summary	Application No. 10/585,970	Applicant(s) SHAH, KAMAL
	Examiner JASON THOMPSON	Art Unit 4166

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *2/25/2008*.
2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.
3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5)☐ Claim(s) _____ is/are allowed.
6)☒ Claim(s) *1-25* is/are rejected.
7)☐ Claim(s) _____ is/are objected to.
8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.
10)☒ The drawing(s) filed on *7/13/2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a)☒ All b)☐ Some * c)☐ None of:
1.☐ Certified copies of the priority documents have been received.
2.☐ Certified copies of the priority documents have been received in Application No. _____.
3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *See Continuation Sheet*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Continuation of Attachment(s) 3). Information Disclosure Statement(s) (PTO/SB/08), Paper No(s)/Mail Date :4.7.2010, 7.20.2007, and 7.13.2006.

DETAILED ACTION

Double Patenting

1. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

2. A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

3. Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

4. Claims 1-3, 7-9, 11, 12, 14, 17-21, 24, and 25 are provisionally rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 2, 8, 13, 14, and 20 of copending Application No. 11/868,155 (`155 application) in view of U.S. Publication Wilkinson (2003/0005722). This is a provisional obviousness-type double patenting rejection.

Regarding claims 1, 17 and 24, claims 1 and 13 of the `155 application claims all of the elements of the instant invention, with the exception of specifically pumping a reflux portion of condensed overhead product to the top of a fractionation unit (or a pump or a means for pumping). Claim 1 of the `155 application merely recites "directing" a reflux stream.

Wilkinson teaches a pump (23) that is capable of directing a reflux stream of overhead product to the top of a fractionation unit. As a result, it would have been obvious to one of ordinary skill in the art, at the time of the invention to have considered pumping the reflux stream as a method of directing a reflux stream, in view of the teachings of Wilkinson, in order to take advantage of well known means of directing streams of fluid.

Regarding claim 2, claim 2 of the copending patent application (11/868,155) teaches all the limitations.

Regarding claim 3, claim 1 of the copending patent application (11/868,155) teaches recovery of petroleum gas or natural gas liquids from LNG, however the claim does not specify the size of said hydrocarbons.

Wilkinson teaches processing of natural gas liquids composed of hydrocarbons with up to and including 3 carbons (Paragraph 5). As a result, it would have been obvious to one of ordinary skill in the art, at the time of the invention that the process of claim 1 of the `155 application would have been applied to a rich gas stream containing C_{2+} hydrocarbons as taught by Wilkinson since Wilkinson teaches this to be a typical analysis of an LNG processing gas stream.

Regarding claim 7, claim 1 of the co-pending patent application (11/868,155) teaches cooling and condensation of an overhead product stream in a cross-exchanger but does not indicate the temperature of the LNG stream at this point.

Wilkinson teaches that overhead product is cooled via a cross-exchanger to a temperature of -123F (Paragraph 38). As a result, it would have been obvious to one of ordinary skill in the art, at the time of the invention to have modified claim 1 of the `155 application to include the overhead product operating temperatures as disclosed by Wilkinson, to improve the LNG conditioning process.

Regarding claim 8, claim 1 of the co-pending patent application (11/868,155) teaches all the limitations.

Regarding claim 9, claim 1 of the co-pending patent application (11/868,155) teaches a primary column feed but does not indicate if it is substantially liquid.

Wilkinson teaches a feed that is substantially liquid, leaving separator (11) to line (33) (Paragraph 34). As a result, it would have been obvious to one of ordinary skill in the art, at the time of the invention to have used a substantially liquid feed column in the process of claim 1 of the `155 application, as disclosed by Wilkinson, to improve the separation process.

Regarding claim 11, claim 1 of the co-pending patent application (11/868,155) teaches all the limitations.

Regarding claim 12, claim 1 of the co-pending patent application (11/868,155) teaches a bottom product stream but does not indicate if it is substantially liquid.

Wilkinson teaches a bottom product (44) that is composed substantially of natural gas liquids (Paragraph 66). As a result, it would have been obvious to one of ordinary skill in the art, at the time of the invention to have used a substantially liquid bottom product stream in the process of claim 1 of the `155 application, as disclosed by Wilkinson, to improve the separation process.

Regarding claim 14, claim 1 of the co-pending patent application (11/868,155) teaches a bottom product stream but does not indicate its temperature after exiting the fractionation unit.

Wilkinson teaches the liquid product stream (41) at the bottom of the fractionation tower as 115F (Paragraph 37). As a result, it would have been obvious to one of ordinary skill in the art, at the time of the invention to have modified the process of claim 1 of the `155 application to include an exit temperature of the bottom product stream, as disclosed by Wilkinson, to improve the separation process.Regarding claim 18, claim 14 of the copending patent application (11/868,155) teaches all the limitations.

Regarding claim 19, claim 1 of the co-pending patent application (11/868,155) discloses a fractionation unit, but does not indicate the number of trays, packed columns, or combinations thereof.

Wilkinson discloses a fractionation tower (19) that contains a plurality of vertically spaced trays, packed beds or a combination thereof (Paragraph 37). As a result, it would have been obvious to one of ordinary skill in the art, at the time of the invention to have provided the process of claim 1 of the `155 application with the specific number of trays, packed columns, or combinations thereof, as disclosed by Wilkinson, to improve the separation process.

Regarding claim 20, claim 1 of the co-pending patent application (11/868,155) discloses all the limitations with the exception of the separation of ethane, propane, and heavier components from methane.

Wilkinson discloses a LNG conditioning apparatus that liquefies and separates a stream of LNG with components heavier than methane (Paragraph 5). As a result, it would have been obvious to one of ordinary skill in the art, at the time of the invention to have used the process of the `155 application to separate ethane, propane, and heavier components from methane, as disclosed by Wilkinson, since Wilkinson teaches this to be a common used to this type of apparatus.

Regarding claim 21, claim 20 of the copending patent application (11/868,155) teaches all the limitations.

Regarding claim 23, claim 12 of the copending patent application (11/868,155) teaches all the limitations.

Regarding claim 25, claim 14 of the copending patent application (11/868,155) teaches all the limitations.

5. Claims 4 and 22 are provisionally rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over the combination of claim 1 of copending Application No. 11/868,155 (`155 application) and Wilkinson (U.S. Publication 2003/0005722) as set forth above, and further view of Keller (U.S. Publication 2003/0005698). This is a <u>provisional</u> obviousness-type double patenting rejection.

Regarding claim 4, the combination of claim 1 of the co-pending patent application (11/868,155) and Wilkinson (U.S. Publication 2003/0005722) teaches operating temperatures of an input stream, cross-exchangers, and vaporizer. However the ranges differ from those claimed.

Keller teaches a system for vaporizing LNG where the system inlet temperature is -249F (Paragraph 37). As a result, it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to consider a LNG recovery method as taught by the combination of claim 1 of the co-pending patent application (11/868,155) and Wilkinson (U.S. Publication 2003/0005722) with an inlet stream temperature as taught by Keller to process and condition inlet LNG streams of lower temperatures.

Regarding claim 22, the combination of claim 1 of the co-pending patent application (11/868,155) and Wilkinson (U.S. Publication 2003/0005722) teaches a reboiler, but does not specify the type of reboiler used.

Keller teaches a submerged combustion vaporizer (SCV). As a result, it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to consider a LNG fractionation tower as disclosed by the combination of claim 1 of the co-pending patent application (11/868,155) and Wilkinson (U.S. Publication 2003/0005722) and to use a SCV reboiler as taught by Keller to allow for improved separation in the fractionation unit.

6. Claim 6 is provisionally rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over the combination of Wilkinson (U.S. Publication 2003/0005722) and claim 1 of copending Application No. 11/868,155 (`155 application) and further in view of McCartney (U.S. Patent 6,564,579).. This is a provisional obviousness-type double patenting rejection.

The combination of McCartney and claim 1 of the co-pending patent application (11/868,155) teaches parameters discussing operating temperatures of an input stream, cross-exchangers, and vaporizer. However the ranges differ from those in the present application.

McCartney teaches the use of heat exchangers for vaporizing LNG streams and heating said streams to a range between 30F and 50F (Column 5, lines 60-64). As a result, it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to consider a LNG recovery method as taught by the combination of Wilkinson and claim 1 of the co-pending patent application (11/868,155) where a stream of LNG could be vaporized via heat exchangers as disclosed by McCartney, to produce a vapor that may be fractionated.

7. Claims 5, 10, 15, and 16 are provisionally rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over the combination of Wilkinson (U.S. Publication 2003/0005722) and claim 1 of copending Application No. 11/868,155 (`155 application) and further in view of Bowen (U.S.

Publication 2003/0014995). This is a provisional obviousness-type double patenting rejection.

Regarding claim 5, the combination of Wilkinson and claim 1 of the co-pending patent application (11/868,155) teaches heating of a direct stream in a cross-exchanger, but the reference does not indicate the temperature of the LNG stream at this point. Bowen teaches an inlet stream of LNG that is heated from -140F to -129F after passing through a pump (110) (Table 1). As a result, it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention to have modified the combination of Wilkinson and claim 1 of the `155 application to include a cross-exchanger temperature of the overhead product stream, as disclosed by Bowen, to improve the LNG conditioning process.

Regarding claim 10, the combination of Wilkinson and claim 1 of the co-pending patent application (11/868,155) teaches a vaporized secondary column, but the combination does not indicate that said stream is preheated.

Bowen teaches gradual heating of an inlet LNG stream via a pump (110), heater (111), and heat exchanger (112) to obtain the desired feed gas temperature (Paragraph 20). As a result, it would have been obvious to one of ordinary skill in the art, at the time of the invention to have modified the combination of Wilkinson and claim 1 of the `155 application to include the overhead product operating temperatures as disclosed by Bowen, to optimize inlet feed gas temperature.

Regarding claims 15 and 16, the combination of Wilkinson and claim 1 of the co-pending patent application (11/868,155) teaches the cooling of the inlet stream in

addition to the cooling and condensation of overhead product stream, but the combination does not disclose this is accomplished with a single cross-exchanger.

Bowen teaches heat transfer between an inlet stream of pressurized liquid natural gas (PLNG) and a stream (100) containing overhead product from a rich oil demethanizer. The inlet PLNG is heated, while the stream containing overhead product stream is cooled (Paragraph 20).

As a result, it would have been obvious to one of ordinary skill in the art, at the time of the invention to have modified the combination of Wilkinson and claim 1 of the `155 application to preheat an inlet stream of PLNG with an overheat product stream an overheat product stream as disclosed by Bowen to optimize feed gas temperature and improve thermal efficiency of the apparatus.

7. Claim 13 is provisionally rejected on the grounds of nonstatutory obviousness-type double patenting as being unpatentable over the combination of Wilkinson (U.S. Publication 2003/0005722) and claim 1 of copending Application No. 11/868,155 (`155 application) and further in view of Chen (2004). This is a <u>provisional</u> obviousness-type double patenting rejection.

Claims 1 and 7 of the co-pending patent application (11/868,155) teaches an overhead product stream and a range for fractionation unit operating pressures, however the overhead product exit temperature differs from the claimed temperature in the present application.

Applicant fails to explicitly disclose the purpose of the range given for the fractionation unit exit temperature. Wilkinson teaches an overhead vapor stream (37) that leaves the fractionation tower at -135F (Wilkinson, paragraph 37), where the operating pressure of said LNG fractionation unit is approximately 465psia (Wilkinson, paragraph 35). Additionally, it is well known in the art that pressure varies directly with temperature in LNG systems (Section 2.5 of Chen). As a result, increased fractionation operating pressures will result in increased operating temperatures. Therefore, the fractionation unit exit temperature is recognized as a result-effective variable, i.e. a variable which achieves a recognized result. In this case, the recognized result is that said exit temperature may be modified by varying the operating pressure of the fractionation unit. Therefore, since the general conditions of the claims (i.e. that temperature or pressure may fall within a range) were disclosed in the prior art by the combination of Wilkinson and claims 1 and 7 of the `155 application in further view of Chen, it is not inventive to discover the optimum workable range by routine experimentation, and it would have been obvious to one of ordinary skill in the art at the time of the invention to operate a fractionation unit with an exit temperature such that overhead product would be maintained in vapor form to allow recovery of said product.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

> invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 1-3, 5, 7-12, 14-21, 24, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wilkinson (U.S. Publication 2003/0005722) further in view of Sun (U.S. Patent 6,607,597 B2) and Bowen (U.S. Publication 2003/0014995).

Regarding claims 1 and 2 Wilkinson teaches a method for splitting a natural gas input stream into two feed columns (34 and 36**),** expansion and vaporization of feed columns via (valve 14) and (expansion machine 15), fractionation of feeds (39a, 35b, 40a, and 36a) with fractionation unit (19) to yield overhead product (37), compression of overhead product by compressor (16), condensation of overhead product stream via cross-exchangers (24 and 60), direction of a reflux stream of overhead product via a pump (23) to the top of a fractionation after passing through a reflux drum (22). However, the reference does not teach, splitting and mixing a bypass stream with a balance of overhead product.

Sun discloses a method for splitting and mixing a balance of input gas for a flow controller to permit dynamic adjustment of output fluid characteristics (Columns 7, lines 58-61). Bypass line (32) diverges from junction (30) and mixes with a balance of fluid and atomizing gas at junction (20J). As a result, it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to include the flow bypass and mixing as taught by Sun in combination with the LNG separation method disclosed by Wilkinson to permit adjustment of the overhead product stream composition.

Further, the combination of Wilkinson and Sun teaches the cooling of the inlet stream in addition to the cooling and condensation of overhead product stream, but the combination does not teach heating of an inlet stream of LNG.

Bowen teaches gradual heating of an inlet LNG stream via a pump (110), heater (111), and heat exchanger (112) to obtain the desired feed gas temperature (Paragraph 20). As a result, it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to include LNG heating methods as taught by Bowen in combination with the LNG separation method disclosed by the combination of Wilkinson and Sun to optimize feed gas temperature.

Regarding claim 3, the combination of Wilkinson, Sun, and Bowen teaches processing of natural gas liquids composed of hydrocarbons with up to and including 3 carbons (Wilkinson Paragraph 5).

Regarding claim 5, the combination of Wilkinson and Sun teaches parameters regarding the operating temperatures of an input stream, cross-exchangers, and vaporizer. However the ranges differ from those in the present application.

Bowen teaches an inlet stream of LNG that is heated from -140F to -129F after passing through a pump (110) (Table 1). As a result, it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to operate a LNG recovery method as taught by the combination of Wilkinson and Sun in combination with the

operating temperatures as taught by Bowen, to facilitate separation and conditioning of LNG.

Regarding claim 7, Wilkinson teaches that overhead product is cooled via a cross-exchanger to a temperature of -123F (Paragraph 38).

Regarding claim 8, Wilkinson teaches a partially condensed stream (42b) that reaches separator (22), where condensed liquid stream (44) is returned to the fractionation units as a reflux stream (Paragraph 66).

Regarding claim 9, Wilkinson teaches a feed that is substantially liquid, leaving separator (11) to line (33) (Paragraph 34).

Regarding claim 10, the combination of Wilkinson and Sun teaches pre-cooling of a feed column, however the reference does not teach pre heating.

Bowen teaches gradual heating of an inlet LNG stream via a pump (110), heater (111), and heat exchanger (112) to obtain the desired feed gas temperature (Paragraph 20). As a result, it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to include preheating of LNG as taught by Bowen in combination with the LNG separation method disclosed by the combination of Wilkinson and Sun to optimize inlet feed gas temperature.

Regarding claim 11, Wilkinson teaches that the overhead product stream is in vapor form after exiting fractionation unit (Paragraph 37).

Regarding claim 12, Wilkinson teaches a bottom product (44) that is composed substantially of natural gas liquids (Paragraph 66).

Regarding claim 14, Wilkinson teaches the liquid product stream (41) at the bottom of the fractionation tower as 115F (Paragraph 37).

Regarding claims 15 and 16, the combination of Wilkinson and Sun teaches the cooling of the inlet stream in addition to the cooling and condensation of overhead product stream, but the reference teaches this is accomplished with intermediate refrigerant and separate cross-exchangers (Paragraph 6).

Bowen teaches heat transfer between an inlet stream of pressurized liquid natural gas (PLNG) and a stream (100) containing overhead product from a rich oil demethanizer. The inlet PLNG is heated, while the stream containing overhead product stream is cooled (Paragraph 20). As a result, it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to consider a LNG separation system as taught by Wilkinson with a method to preheat an inlet stream of PLNG with an overheat product stream as disclosed by Bowen to optimize feed gas temperature and improve thermal efficiency of the apparatus.

Regarding claims 17 and 18, Wilkinson teaches an apparatus for splitting a natural gas input stream into two feed columns (34 and 36), expansion and vaporization of feed columns via (valve 14) and (expansion machine 15), fractionation of feeds (39a, 35b, 40a, and 36a) with fractionation unit (19) to yield overhead product (37), compression of overhead product by compressor (16), condensation of overhead product stream via cross-exchangers (24 and 60), direction of a reflux stream of overhead product via a pump (23) to the top of a fractionation after passing through a reflux drum (22). Wilkinson also teaches the cooling of the inlet stream in addition to the cooling and condensation of overhead product stream, but the reference teaches this is accomplished with intermediate refrigerant and separate cross-exchangers (Paragraph 6).

Bowen teaches heat transfer between an inlet stream of pressurized liquid natural gas (PLNG) and a stream (100) containing overhead product from a rich oil demethanizer. The inlet PLNG is heated, while the stream containing overhead product stream is cooled (Paragraph 20). As a result, it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to consider a LNG separation system as taught by Wilkinson with a cross-exchanger for preheating inlet PLNG with an overhead product stream as disclosed by Bowen to optimize feed gas temperature and improve thermal efficiency of the apparatus.

Further, the combination of Wilkinson and Sun does not teach splitting and mixing a bypass stream with a balance of overhead product.

Sun discloses a method for splitting and mixing a balance of input gas for a flow controller to permit dynamic adjustment of output fluid characteristics (Columns 7, lines 58-61). Bypass line (32) diverges from junction (30) and mixes with a balance of fluid and atomizing gas at junction (20J). As a result, it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to include the flow bypass and mixing as taught by Sun with the LNG separation method disclosed by the combination of Wilkinson and Bowen to permit adjustment of the overhead product stream composition.

Regarding claim 19, Wilkinson discloses a fractionation tower (19) that contains a plurality of vertically spaced trays, packed beds or a combination thereof (Paragraph 37).

Regarding claim 20, Wilkinson discloses a LNG conditioning apparatus that liquefies and separates a stream of LNG with components heavier than methane (Paragraph 5).

Regarding claim 21, Wilkinson teaches a reboiler (20) that draws a stream from the fractionation unit, adds heat to said stream, then re-injects the heated stream to the fractionation unit (Paragraph 65).

Regarding claims 24 and 25, Wilkinson (2003/0005722) teaches a system (method and apparatus) for splitting a natural gas input stream into two feed columns (34 and 36), expansion and vaporization of feed columns via (valve 14) and (expansion machine 15), fractionation of feeds (39a, 35b, 40a, and 36a) with fractionation unit (19) to yield overhead product (37), compression of overhead product by compressor (16), condensation of overhead product stream via cross-exchangers (24 and 60), direction of a reflux stream of overhead product via a pump (23) to the top of a fractionation after passing through a reflux drum (22). Wilkinson also teaches the cooling of the inlet stream in addition to the cooling and condensation of overhead product stream, but the reference teaches this is accomplished with intermediate refrigerant and separate cross-exchangers (Paragraph 6).

Bowen teaches heat transfer between an inlet stream of pressurized liquid natural gas (PLNG) and a stream (100) containing overhead product from a rich oil demethanizer. The inlet PLNG is heated, while the stream containing overhead product stream is cooled (Paragraph 20). As a result, it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to consider a LNG separation system as taught by Wilkinson whereby an overheat product stream is used to preheat inlet PLNG as disclosed by Bowen to optimize feed gas temperature and improve thermal efficiency of the apparatus.

Further, the combination of Wilkinson and Bowen does not teach splitting and mixing a bypass stream with a balance of overhead product.

Sun discloses a method for mixing a balance of input gas for a flow controller to permit dynamic adjustment of output fluid characteristics (Columns 7, lines 58-61). Bypass line (32) diverges from junction (30) and mixes with fluid and atomizing gas at junction (20J). As a result, it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to include the flow bypass and mixing as taught by Sun with the LNG separation method disclosed by the combination of Wilkinson and Bowen to permit further adjustment of the overhead product stream composition.

10. Claims 4, 22, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Wilkinson (U.S. Publication 2003/0005722), Sun (U.S. Patent 6,607,597 B2), Bowen (U.S. Publication 2003/0014995), and further in view of Keller (U.S. Publication 2003/0005698).

Regarding claim 4, the combination of Wilkinson, Sun and Bowen teaches parameters discussing operating temperatures of an input stream, cross-exchangers, and vaporizer. However the ranges differ from those claimed.

Keller teaches a system for vaporizing LNG where the system inlet temperature is -249F (Paragraph 37). As a result, it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to consider a LNG recovery method as taught by the combination of Wilkinson, Sun, and Bowen with an inlet stream temperature as taught by Keller to process and condition inlet LNG streams of lower temperatures.

Regarding claim 22, the combination of Wilkinson, Sun and Bowen discloses a reboiler, but does not specify the type of reboiler used.

Keller teaches a submerged combustion vaporizer (SCV). As a result, it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to consider a LNG fractionation tower as disclosed by the combination of Wilkinson, Sun, and Bowen and to use a SCV reboiler as taught by Keller to allow for improved separation in the fractionation unit.

Regarding claim 23, the combination of Wilkinson, Sun, and Bowen teaches vaporization of streams via expanders (14) and (16), however the references do not specify a heat source.

Keller teaches a submerged combustion reboiler that burns a portion of the LNG stream to vaporize said stream (Paragraph 7). As a result, it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to consider a LNG separation apparatus as disclosed by the combination of Wilkinson, Sun, and Bowen and to utilize submerged combustion vaporizers as taught by Keller, to vaporize a portion of a LNG feed stream for reboiling.

11. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Wilkinson (U.S. Publication 2003/0005722), Sun (U.S. Patent 6,607,597

B2), Bowen (U.S. Publication 2003/0014995), and further in view of McCartney (U.S. Patent 6,564,579).

The combination of Wilkinson, Sun, and Bowen teaches parameters discussing operating temperatures of an input stream, cross-exchangers, and vaporizer. However the ranges differ from those in the present application.

McCartney teaches the use of heat exchangers for vaporizing LNG streams and heating said streams to a range between 30F and 50F (Column 5, lines 60-64). As a result, it would have been obvious to one of ordinary skill in the art, at the time of applicant's invention, to consider a LNG recovery method as taught by the combination of Wilkinson, and Bowen where a stream of LNG could be vaporized via heat exchangers as disclosed by McCartney, to produce a vapor that may be fractionated.

12. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Wilkinson (U.S. Publication 2003/0005722) and Bowen (U.S. Publication 2003/0014995), in further view of (Chen 2004)

The combination of Wilkinson, and Bowen teaches an exit temperature for an overhead product stream and an approximate fractionation unit operating pressure, however the overhead product exit temperature differs from the claimed temperature in the present application.

Applicant fails to explicitly disclose the purpose of the range given for the fractionation unit exit temperature. Wilkinson teaches an overhead vapor stream (37) that leaves the fractionation tower at -135F (Wilkinson, paragraph 37), where the operating pressure of said LNG fractionation unit is approximately 465psia (Wilkinson,

paragraph 35). Additionally, it is well known in the art that pressure varies directly with temperature in LNG systems (Section 2.5 of Chen). As a result, increased fractionation operating pressures will result in increased operating temperatures. Therefore, the fractionation unit exit temperature is recognized as a result-effective variable, i.e. a variable which achieves a recognized result. In this case, the recognized result is that said exit temperature may be modified by varying the operating pressure of the fractionation unit. Therefore, since the general conditions of the claims (i.e. that temperature or pressure may fall within a range) were disclosed in the prior art by the combination of Wilkinson and Bowen in further view of Chen, it is not inventive to discover the optimum workable range by routine experimentation, and it would have been obvious to one of ordinary skill in the art at the time of the invention to operate a fractionation unit with an exit temperature such that overhead product would be maintained in vapor form to allow recovery of said product.

Conclusion

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Dunbar (U.S. Patent 5,916,260) discloses LNG liquefaction

Price (U.S. Patent 6,367,286) discloses LNG separation

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JASON THOMPSON whose telephone number is (571)270-1852. The examiner can normally be reached on monday-thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian Casler can be reached on (571)272-4956. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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JNT
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